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Kawai et al.

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[45] **Date of Patent: Nov. 19, 1996**

[54] **FEEDING UNIT**

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[30] **Foreign Application Priority Data**

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[51] **Int. Cl.**^{6} **B41F 27/06**

[52] **U.S. Cl.** **101/477**; 101/118; 101/408

[58] **Field of Search** ..... 101/118, DIG. 36, 101/408, 415.1, 477, 389.1

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[57] **ABSTRACT**

A stencil discharging unit of a rotary stencil printing machine has a feeding unit and a stencil discharging container. The feeding unit has a first feeding means and a second feeding means. The first feeding means that is on the upper side includes groups of pulleys and groups of belts. The second feeding means that is on the lower side includes groups of pulleys and groups of belts. The pulleys in each group are pitched at a predetermined interval in an axial direction. The respective pulleys are supported by support members that are independent of one another. Each support member is mounted on a plate member that has bending resiliency. Springs urge the plate member upward. With the plate member bent, the respective pulleys are displaced independently of one another.

10 Claims, 4 Drawing Sheets

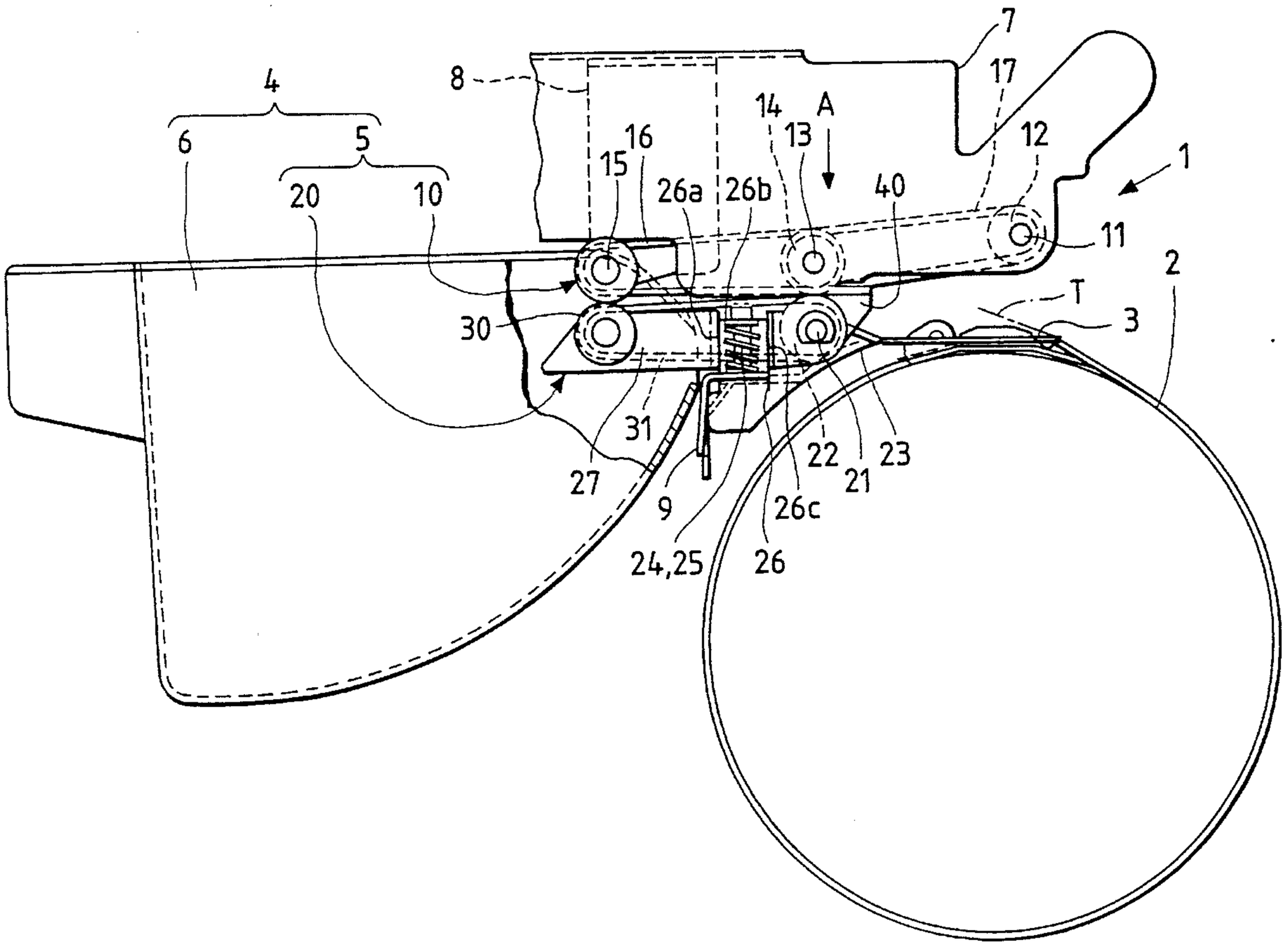
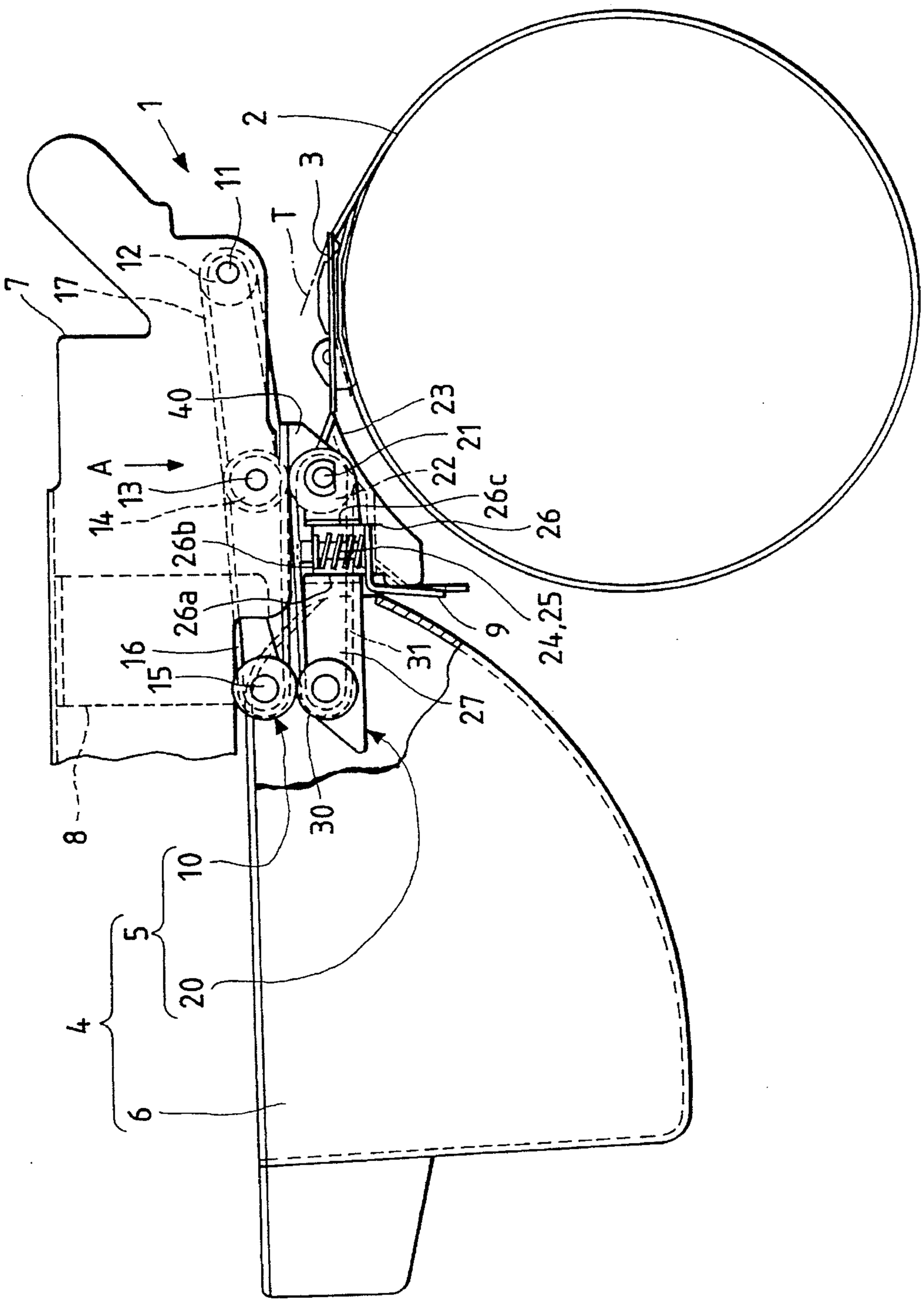


FIG. 1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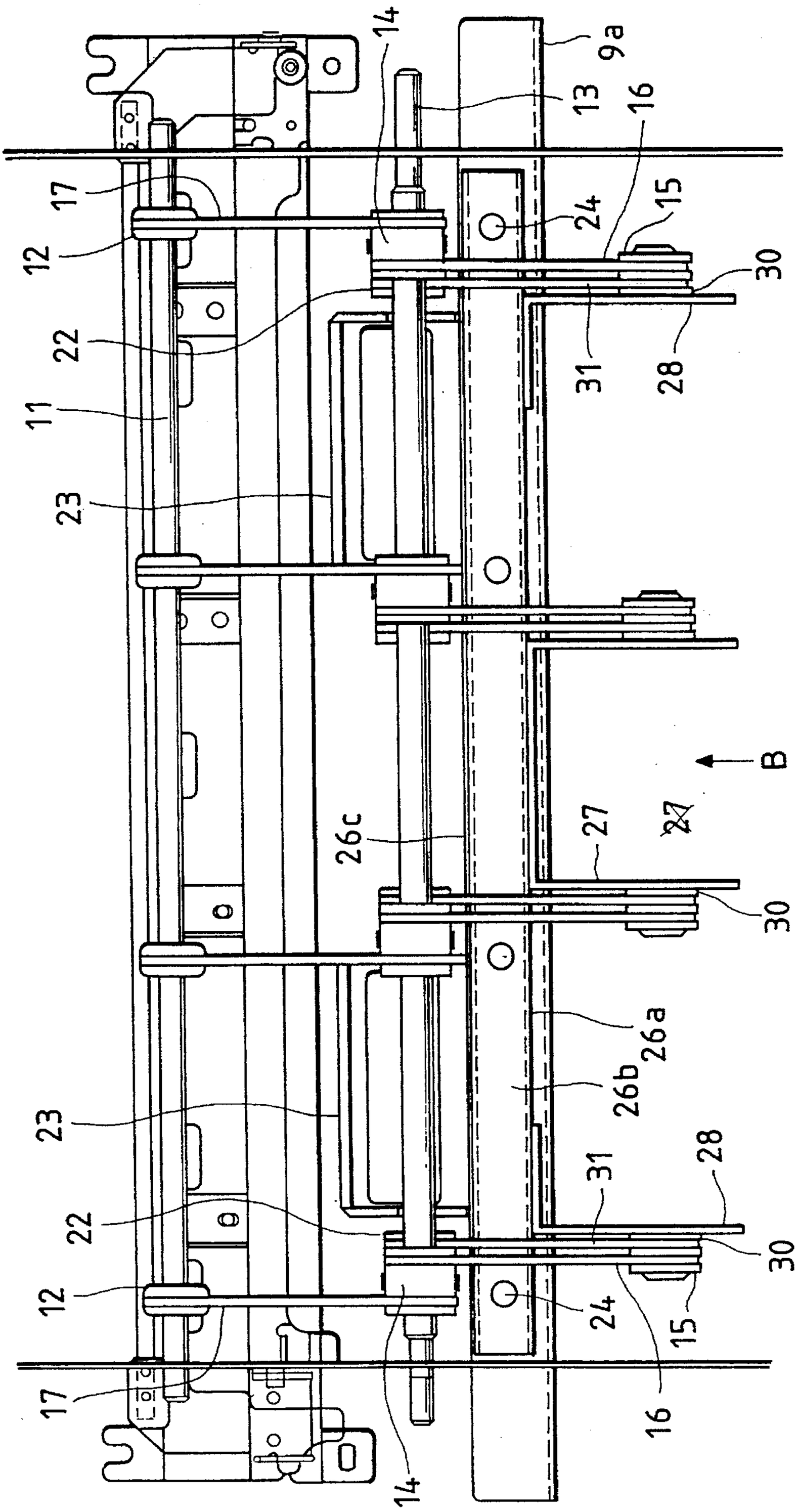
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FIG. 2

FIG. 3

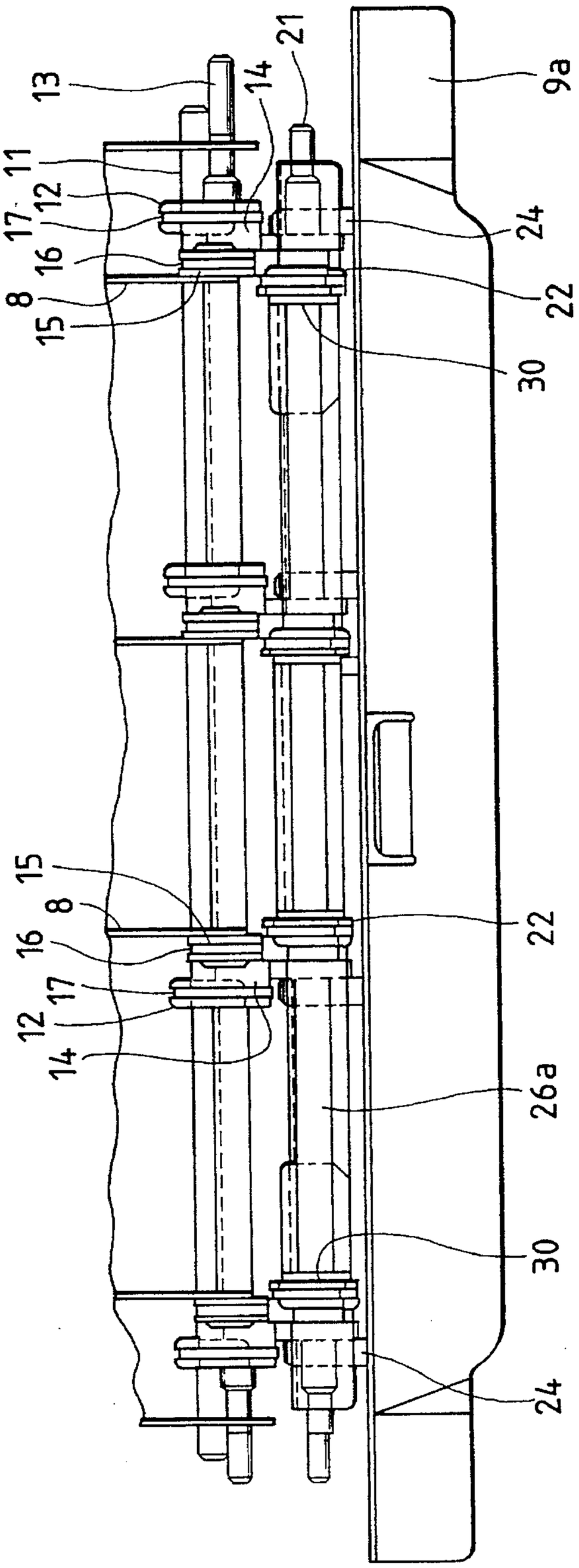
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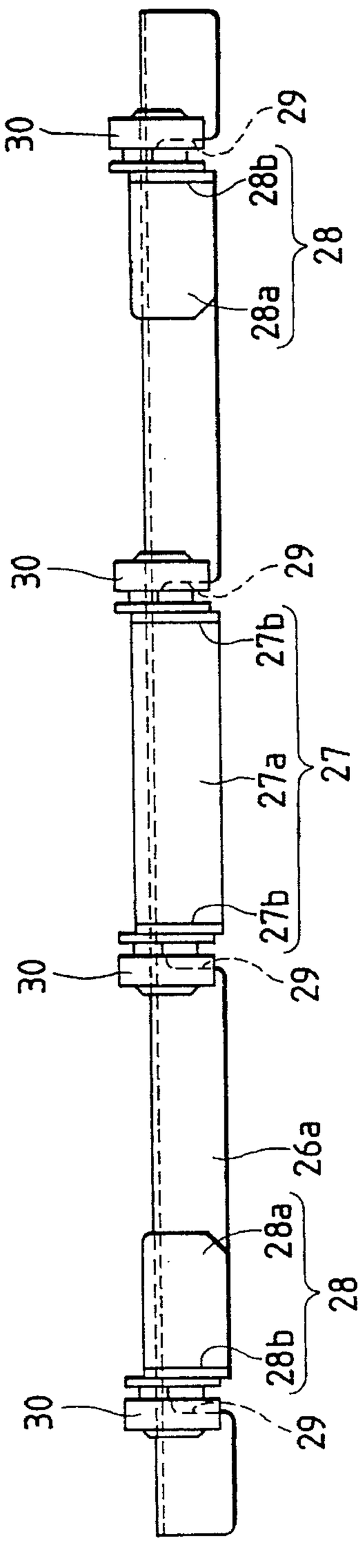
FIG. 4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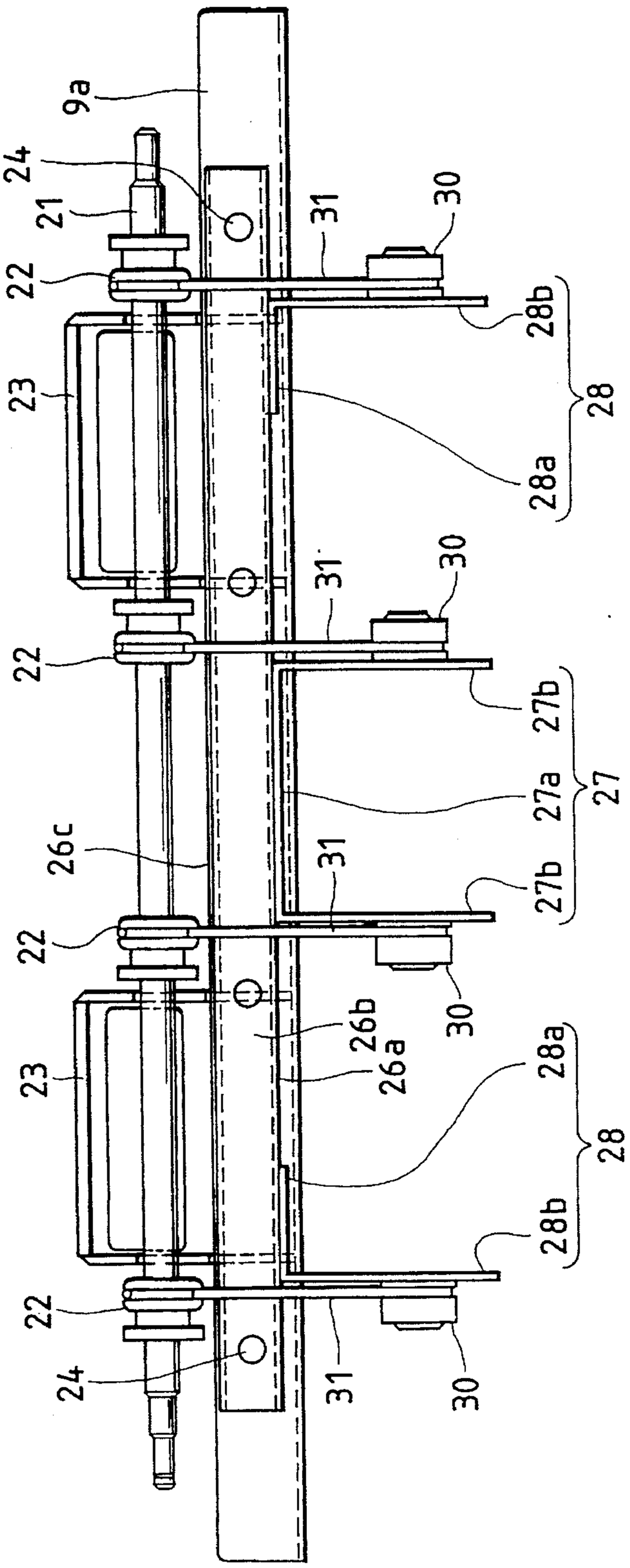
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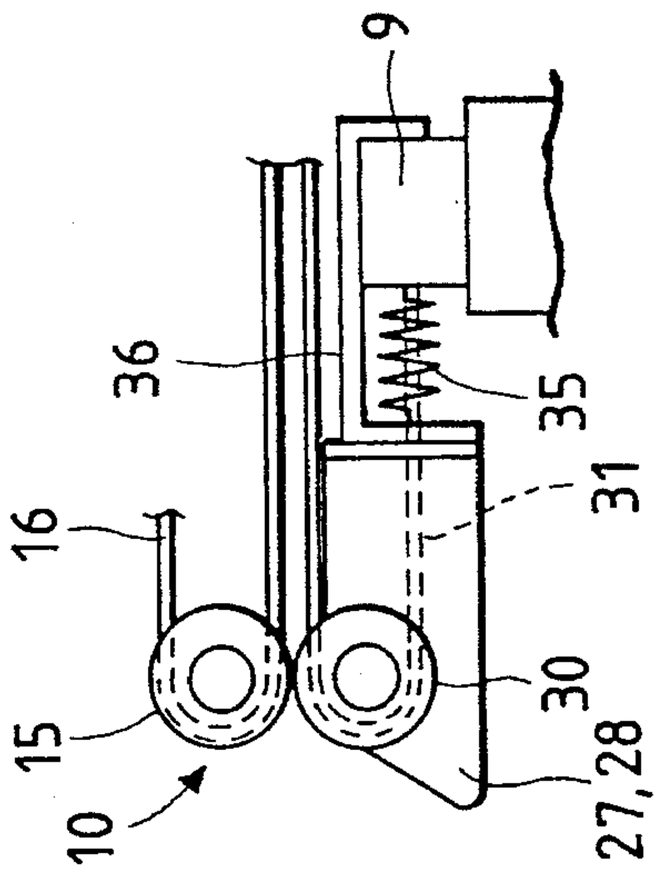
28b

FIG. 5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27,28

FIG. 6

FEEDING UNIT

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to a feeding unit having a forwarding mechanism in which belts are installed around a plurality of pulleys. More specifically, the invention relates to, for instance, a feeding unit for forwarding consumed stencil paper to a predetermined scrapping position in stencil printing machines and the like.

2. Description of Related Art

A rotary stencil printing machine has a cylindrical drum that is driven to rotate about a shaft center thereof. At least a part of the circumferential wall of the cylindrical drum is used as a printing region through which ink can pass. An ink supply means for supplying the ink into the inner surface of the circumferential wall is provided inside the cylindrical drum. A perforated stencil paper for performing the stencil printing is wound around the outer circumfernetial surface of the cylindrical drum. A printing sheet fed as the cylindrical drum rotates is pressed onto the cylindrical drum by pressing means arranged on the outer side of the cylindrical drum. The ink is introduced into the printing sheet through an image formed on the perforated stencil paper wound around the cylindrical drum, so that the stencil printing can be performed on the printing sheet.

The aforementioned stencil printing machine includes: a stencil discharging container that contains a consumed stencil paper; and a feeding unit that forwards the consumed stencil paper to the stencil discharging container. Some feeding units employ a feeding mechanism that includes pulleys and belts.

That is, a plurality of pulleys are pitched at a predetermined interval on each of two parallel running rotary shafts, and belts are installed around the pulleys of one rotary shaft and those of the other rotary shaft, respectively. The thus constructed feeding means are arranged so as to confront each other up and down. By rotating both feeding means in directions opposite to each other, a consumed stencil paper is fed while nipped by the belts of the upper and lower feeding means.

A conventional feeding unit employed in the stencil printing machine can forward a consumed stencil paper without any problem as long as the thickness of the stencil paper is uniform. If the consumed stencil paper is partially folded and has the folds bonded to each other by the ink, then the thickness of the stencil paper may, in some cases, becomes ununiform in a width direction that is orthogonal to a stencil paper forwarding direction. In such cases, the belts of the feeding unit do not come in contact with the thinner portion of the stencil paper adequately, which prevents the stencil paper from being forwarded in the correct condition, causing the stencil paper to jam along the forwarding path.

SUMMARY OF THE INVENTION

The invention has been made in view of the aforementioned problem. The object of the invention is, therefore, to provide a feeding unit capable of forwarding a sheetlike body such as a stencil paper correctly even if the thickness of such sheetlike body becomes ununiform.

According to a first aspect of the invention, a feeding unit comprises: first feeding means including, a plurality of pulleys arranged to confront one another, each having an axis and being rotatable around the axis, and a belt installed around the pulleys, wherein a set is defined by the pulleys and the belt therearound, and a plurality of sets are provided and juxtaposed along pulley's axial directions; second feeding means including, a plurality of pulleys arranged to confront one another, each having an axis and being rotatable around the axis, and a belt installed around the pulleys, wherein a set is defined by the pulleys and the belt therearound, a plurality of sets are provided and juxtaposed along pulley's axial directions, the pulleys of the second feeding means are located at the corresponding position to the respective pulleys of the first feeding means; and support means for urging the respective pulleys belonging to at least a single pulley group, the single pulley group being defined by the pulleys arranged along a common axis in either one of the first feeding means and the second feeding means, toward confronting the other one of the first feeding means and the second feeding means with a predetermined force independently from the other pulleys belonging to the same single pulley group.

According to a second aspect, a feeding unit of the first aspect, wherein the support means includes: a plurality of support members for rotatably supporting a plurality of pulleys arranged along one of common axis; a plate member to which the support members are attached, the plate member having bending resiliency; a support portion for supporting the plate member so as to keep the bending resiliency of the plate member; and urging means for urging the plate member wherein the pulleys arranged along the one of the common axis come in contact with the corresponding pulleys belonging to the confronting feeding means.

According to a third aspect, a feeding unit of the second aspect, wherein a notch is formed at least one of positions, each position being between mounting portions of the support members.

At least the pulleys belonging to one group of pulleys in one of the feeding means are supported by the support means independently of one another and are urged towards the corresponding pulleys of the other feeding means. Even if the thickness of a screen printing stencil paper becomes ununiform across the width in the case of forwarding a screen printing stencil paper, the respective pulleys juxtaposed in the axial direction can nip the screen printing stencil paper with respect to the confronting pulleys under a uniform pressure. The single-sided contact of the screen printing stencil paper with the pulleys can be prevented, which in turn allows the screen printing stencil paper to be forwarded correctly.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side view of a first embodiment of the invention;

FIG. **2** is a partial view in a direction indicated by an arrow A in FIG. **1**;

FIG. **3** is a partial view in a direction indicated by an arrow B in FIG. **2**;

FIG. **4** shows lower second pulleys **30**, a plate member **26**, and support members as viewed in the direction indicated by the arrow B in FIG. **2**;

FIG. **5** shows a first feeding means **10** as viewed in the direction indicated by the arrow A in FIG. **1**; and

FIG. **6** is a partial view of a second embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A rotary stencil printing machine, which is a first embodiment of the invention, will now be described with reference to FIGS. **1** to **5**.

This rotary stencil printing machine includes a feeding unit of the invention as a feeding mechanism in the stencil discharging unit. The rotary stencil printing machine **1** has a cylindrical drum **2**, which is cylindrical in shape. The cylindrical drum **2** is driven by drive means (not shown) and rotates in the counterclockwise direction about the central shaft line thereof as viewed in FIG. **1**. A printing region through which ink passes and a non-printing region through which the ink does not pass are formed over the circumferential wall of the cylindrical drum **2**. Within the cylindrical drum **2** is an ink supply means (not shown) that supplies the ink into the inner surface of the circumferential wall. A locking unit **3** is provided on the outer circumferential surface of the non-printing region on the cylindrical drum **2**. The locking unit **3** holds the leading end of a screen printing stencil paper wound around the cylindrical drum **2**.

As shown in FIG. **1**, the stencil discharging unit **4** is arranged on the left side of the cylindrical drum **2**. The stencil discharging unit **4** scraps the consumed stencil paper by peeling the stencil paper off the outer circumferential surface of the cylindrical drum **2**. The stencil discharging unit **4** has a feeding unit **5** and a stencil discharging container **6** that contains the consumed stencil paper that is forwarded by the feeding unit **5**.

The feeding unit **5** includes first and second feeding means **10**, **20**, each including a plurality of belts and a plurality of pulleys. As shown in FIG. **1**, the first feeding means **10** is mounted on an opening/closing plate **7** arranged above the cylindrical drum **2**. The opening/closing plate **7** serves as a cover body constituting the upper surface of a frame body (not shown) in the rotary stencil printing machine **1**, and has the left end portion thereof not shown in FIG. **1** rotatably coupled to the frame body.

As shown in FIG. **1**, a first upper rotary shaft **11** is rotatably arranged on the right end of the opening/closing plate **7**. The first upper rotary shaft **11** runs in parallel with the central shaft line of the cylindrical drum **2**. Four first upper pulleys **12** are pitched at a predetermined interval along the first upper rotary shaft **11**.

A second upper rotary shaft **13** is rotatably arranged next to the first upper rotary shaft **11** in the consumed stencil paper discharging direction (to the left as viewed in FIG. **1**). The second upper rotary shaft **13** runs in parallel with the first upper rotary shaft **11**. Four second upper pulleys **14** are pitched at a predetermined interval along the second upper rotary shaft **13**. Each second upper pulley **14** has two rows of grooves, so that two belts can be installed.

Four third upper pulleys **15** are pitched at a predetermined interval next to the second upper rotary shaft **13** in the consumed stencil paper discharging direction (to the left as viewed in FIG. **1**). The third upper pulleys **15** are mounted on a plurality of support plates **8** that are fixed to the opening/closing plate **7** so that the pulleys **15** can rotate about the shaft lines thereof. The respective shaft lines of the third upper pulleys **15** run in parallel with the first upper rotary shaft **11** and the second upper rotary shaft **13**. It may be noted that the support plates **8** for rotatably supporting the third upper pulleys **15** are not shown in FIG. **2**.

As shown in FIGS. **1** and **2**, belts **16** are installed around the third upper pulleys **15** and the second upper pulleys **14** whose positions in the axial direction correspond to each other, respectively. Belts **17** are installed around the second upper pulleys **14** and the first upper pulleys **12** whose positions in the axial direction correspond to each other, respectively. When the second upper rotary shaft **13** is driven, the first upper pulleys **12**, the second upper pulleys **14**, and the third upper pulleys **15** are rotated in the same direction, and so do the belts **16**, **17** in the same direction in circulation. In FIG. **1**, the respective pulleys **12**, **14**, **15** and the respective belts **16**, **17** rotate in the clockwise direction.

As shown in FIG. **1**, the second feeding means **20** is placed on a structural body (fixed portion) **9** of the rotary stencil printing machine **1** under the first feeding means **10**. As shown in FIG. **3**, a first lower rotary shaft **21** is rotatably arranged above the structural body **9**. The first lower rotary shaft **21** runs in parallel with the second upper rotary Shaft **13**, and is arranged right under the second upper rotary shaft **13**. Four first lower pulleys **22** are pitched at a predetermined interval along the first lower rotary shaft **21**. The first lower pulleys **22** are positioned so as to nearly come in contact with the second upper pulleys **14**, respectively.

As shown in FIGS. **1**, **2**, and **5**, two separating pawls **23** are arranged below the first lower rotary shaft **21**. These two separating pawls **23** are fixed to the structural body **9**, each having a wedgelike end which orients toward the top of the cylindrical drum **2**. When the locking unit **3** is released, the leading end of the stencil paper wrapped around the cylindrical drum **2** becomes free. When the cylindrical drum **2** then rotates, the leading end of the stencil paper is guided to the two separating pawls **23** to be threaded between the first feeding means **10** and the second feeding means **20**.

The first lower rotary shaft **21** is rotatably supported by a support member **40** that is fixed to a side plate **26***c* of the plate member **26** on the structural body **9**. The structural body **9** is substantially L-shaped in cross-section and runs in parallel with the first lower rotary shaft **21**. The structural body **9** is fixed to a main body (not shown) of the stencil printing machine. As shown in FIGS. **1** to **3**, four rodlike columns **24** are fixed at an interval on the upper surface of the structural body **9**. A coil spring **25**, which serves as an urging means, is fitted over each column **24**. The plate member **26** is mounted onto the respective columns **24** through the corresponding coil springs **25**.

As shown in FIG. **1**, the plate member **26** is formed by bending an elongated thin plate at both widthwise edge portions at right angles along the length thereof; i.e., the plate member **26** includes a center plate **26***b* and two side plates **26***a*, **26***c* interposing the center plate **26***b*. The side plate **26***a* may be merely called the plate member in the description of the present invention. The center plate **26***b* of the plate member **26** has four holes at a predetermined interval. The columns **24** are inserted into the respective holes, so that the plate member **26** is supported by the coil springs **25**. If a downwardly urging force is applied to the plate member **26**, the plate member **26** receives an upwardly urging force by the resiliency of the coil springs **25**. The center plate **26***b* and the columns **24** arranged on the structural body **9** serve as a support portion in the present invention.

As shown in FIGS. **4**, **5**, three support members **27**, **28** are fixed to the side plate **26***a*. The support member **27** in the middle has a base portion **27***a* and two support portions **27***b*, **27***b* projecting frontward from both sides of the base portion **27***a*. Each of the two support members **28**, **28** on both sides has a base portion **28***a* and a support portion **28***b* projecting frontward continuous to the base portion **28***a*. As shown in

FIG. 4, the side plate **26***a* has four notches **29** in the front surface thereof. Two notches **29** are arranged on both sides of the support member **27** in the middle and two notches **29** outside the support members **28**, **28** on both sides.

As shown in FIGS. **4**, **5**, second lower pulleys **30** are arranged one each to the respective support portion **27***b*, **28***b* of the support members **27**, **28**. The four second lower pulleys **30** are rotatably attached to the respective support portion **27***b*, **28***b* through independent rotary shafts. Although the rotary shafts of the four second lower pulleys **30** are independent of one another, the shaft lines thereof coincide with one another. The second lower pulleys **30** are in contact with the third upper pulleys **15** if nothing therebetween, respectively, and the respective coil springs **25** supporting the plate member **26** to which the second lower pulleys **30** are attached are in a pressed condition. Therefore, each second lower pulley **30** presses the corresponding third upper pulley **15** at a predetermined urging force by the resiliency of the corresponding coil spring **25**. Further, each coil spring **25** also functions as causing the corresponding first lower pulley **22** to urge the corresponding second upper pulley **14**.

The plate member **26** is made of a metal plate that has a predetermined resiliency against bending, and the side plates **26***a*, **26***c* are resiliently deformable with respect to the center plate **26***b* around the bending edges thereof. Further, as described above, the notch **29** is formed at each portion of the side plate **26***a* between the two adjacent support members **27** and **28**. Therefore, the three support. members **27**, **28** can be displaced independently of one another by recoverably deforming the portions of the side plate **26***a* defined by the respective notches **29** with respect to the center plate **26***b*. Hence, the four second lower pulleys **30** that are arranged on such support members **27**, **28** can also move independently of one another. Since the two second lower pulleys **30**, **30** in the middle are arranged on the common support member **27**, the movements of both pulleys affect each other, but are not necessarily the same.

As shown in FIG. **5**, the belts **31** are respectively installed around the first lower pulleys **22** and the second lower pulleys **30** whose positions in the axial direction correspond to each other. Each belt **31** moves endlessly across the plate member **26** and the corresponding notch **29**. When the first lower rotary shaft **21** is driven, the first lower pulleys **22**, the second lower pulleys **30**, and the belts **31** rotate in the same direction. In FIG. **1**, each of the pulleys **22**, **30** and each belt **31** rotate in the counterclockwise direction.

Next to the feeding unit **5** is the stencil discharging container **6** that contains consumed stencil paper. The third upper pulleys **15** and the second lower pulleys **30** are arranged to face the entrance of the stencil discharging container **6**.

The operation of the thus constructed rotary stencil printing machine at the time of discharging the consumed stencil paper will be described. Upon end of printing, the locking unit **3** is released. The leading end T of the perforated stencil paper for stencil printing wound around the cylindrical drum **2** is freed as shown by the one dot chain line in FIG. **1**. The first feeding means **10** and the second feeding means **20** are driven, and the cylindrical drum **2** is rotated. The leading end of the stencil paper is introduced between the first feeding means **10** and the second-feeding means **20** while guided by the two separating pawls **23**. When the leading end of the stencil paper has come in contact with the belts **17** between the first upper pulleys. **12** of the first feeding means **10** and the second upper pulleys **14** of the first feeding means **10**, the leading end of the stencil paper is guided along the belts **17** to be introduced between the first feeding means **10** and the second feeding means **20**. The stencil paper is forwarded towards the stencil discharging container **6** while nipped between the belts **16** of the first feeding means **10** and the belts **31** of the second feeding means **20**.

The second lower pulleys **30** of the second feeding means **20** are supported by the support means **27**, **28** so as to be movable independently of one another within a resilient deformable range. Further, each second lower pulley **30** is in contact with the corresponding third upper pulley **15** of the first feeding means **10** with a predetermined force. Even if the thickness of the stencil paper that is being forwarded becomes ununiform across the width, the four second lower pulleys **30** can be moved independently of one another by accommodating the fluctuations in the thickness of the stencil paper, which in turn allows the second lower pulleys **30** to nip the stencil paper at a uniform pressure together with the third upper pulleys **15** that confront the second lower pulleys **30**. Therefore, the one-sided contact of the stencil paper with the belts **16**, **31** can be prevented, which in turn allows the stencil paper to be forwarded correctly.

FIG. **6** is a partial view of a second embodiment of the invention.

Parts that are not shown in the drawing are the same as those of the first embodiment. The second embodiment is distinguished from the first embodiment in the structure for supporting the second lower pulleys **30**. A base end portion of a plate member **36** having bending resiliency is fixed to the structural body **9**. The support members **27**, **28** are fixed to the front end portion of the plate member **36** which serves as a free end. The second lower pulleys **30** are rotatably attached to the support members **27**, **28**. Between the front end portion of the plate member **36** and the structural body **9** are coil springs **35**, each of which serves as an urging means. Each coil spring **35** urges the front end portion of the cantilevered plate member **36** upward, so that the second lower pulleys **30** urges the third upper pulleys **15** upward with a predetermined force. The second embodiment can provide the same operation and advantages as the first embodiment.

In the aforementioned embodiments, the second lower pulleys **30** are supported independently of one another with the plate members **26**, **36** or the like that have bending resiliency, and the second lower pulleys **30** are brought into contact with the third upper pulleys **15** with the coil springs **25**, **35**. By supporting the other pulleys in a structure similar to that for the second lower pulleys **30**, fluctuations in the thickness of the stencil paper that is being forwarded can be accommodated with further flexibility.

The aforementioned embodiments relate to the stencil paper feeding unit for the stencil discharging unit. However, the feeding unit of the invention is not applied only to the forwarding of the consumed stencil paper, but is, of course, applicable to sheetlike bodies to be forwarded including printing paper. In a printing paper feeding unit for a printing apparatus, in particular, one may, in some cases, encounter inconveniences such as the diverting of the sheet forward direction with a one-sided forwarding force applied to a sheet or the jamming of the sheet along a forwarding path when the sheet that is narrower than the width of the feeding unit is to be forwarded. According to the feeding unit of the invention, the sheet can be forwarded correctly even if such sheet whose width is smaller than that of the forward unit is forwarded.

According to the feeding unit of the invention, a work to be forwarded can be forwarded correctly even if the thick-

ness of the work to be forwarded becomes ununiform across the width, which in turn contributes to avoiding such inconvenience as jamming the work to be forwarded along a forwarding path.

What is claimed is:

1. A feeding unit comprising:

first feeding means including,

a plurality of pulleys arranged to confront one another, each having an axis and being rotatable around said axis, and

a belt installed around said pulleys, wherein a set is defined by said pulleys and said belt therearound, and a plurality of sets are provided and juxtaposed along pulley's axial directions;

second feeding means including,

a plurality of pulleys arranged to confront one another, each having an axis and being rotatable around said axis, and

a belt installed around said pulleys, wherein a set is defined by said pulleys and said belt therearound, a plurality of sets are provided and juxtaposed along pulley's axial directions, said pulleys of said second feeding means are located at the corresponding position to said respective pulleys of said first feeding means; and

support means for urging the respective pulleys belonging to at least a single pulley group, the single pulley group being defined by said pulleys arranged along a common axis in either one of said first feeding means and said second feeding means, toward confronting the other one of said first feeding means and said second feeding means with a predetermined force independently from the other pulleys belonging to the same single pulley group.

2. A feeding unit according to claim **1**, wherein said support means includes:

a plurality of support members for rotatably supporting a plurality of pulleys arranged along one of common axis;

a plate member to which said support members are attached, said plate member having bending resiliency;

a support portion for supporting said plate member so as to keep the bending resiliency of said plate member; and

urging means for urging said plate member wherein said pulleys arranged along said one of the common axis come in contact with said corresponding pulleys belonging to the confronting feeding means.

3. A feeding unit according to claim **2**, wherein a notch is formed at least one of positions, each position being between mounting portions of said support members.

4. A feeding unit for feeding a work, comprising:

a first-pulley shaft;

first pulleys secured on said first-pulley shaft;

second pulleys having a common axis paralleling said first-pulley shaft, said second pulleys being positioned downstream with respect to said first pulleys;

mounting members on which said respective second pulleys are rotatably mounted;

belts installed between said respective first pulleys and said respective second pulleys;

a third-pulley shaft paralleling said first-pulley shaft, said third-pulley shaft positioned the opposite side to said first-pulley shaft with respect to the work;

third pulleys secured on said third-pulley shaft, said third pulleys being confronting said respective first pulleys;

fourth pulleys having a common axis paralleling said third-pulley shaft, said fourth pulleys being positioned downstream with respect to said third pulleys and being confronting said respective second pulleys;

belts installed between said respective third pulleys and said respective fourth pulleys; and

a support member on which said fourth pulleys are rotatably mounted, wherein said support member individually urges said fourth pulleys toward said second pulleys.

5. A feeding unit according to claim **4**, wherein said support member includes:

fourth-pulley support members rotatably supporting said respective fourth pulleys;

a plate member to which said fourth-pulley support members are attached, said plate member having bending resiliency;

a support portion supporting said plate member with keeping the bending resiliency of said plate member; and

a spring urging said plate member.

6. A feeding unit according to claim **5**, wherein said plate member has a notch between positions where said forth-pulley support members are attached.

7. A feeding unit according to claim **5**, wherein each of said fourth-pulley support members is movable individually from the other fourth-pulley support members by deforming said plate member.

8. A feeding unit according to claim **5**, wherein said plate member and said support portion are made of a metal plate.

9. A feeding unit according to claim **5**, wherein said fourth-pulley support members are attached to extend from said plate member toward downstream.

10. A feeding unit according to claim **5**, wherein said support member further includes a column under said support portion, and said spring of said support member is a coil spring wound around said column.

* * * * *